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ABSTRACT

The development and implementation of a planning and institutional research subsystem by Grambling State University (GSU) are described. Three components of the subsystem are as follows: the Grambling Institutional Data System (GRIDS), simulation and forecasting models, and the management reporting system. The way that GSU has improved the allocation of the institution's resources is also discussed. Principles guiding system implementation include: producing tangible system outputs early, incorporating maximum flexibility in the system, and developing standard data definitions. GRIDS consists of a historical database and a collection of reporting routines to produce formatted tables. The historical database contains financial and academic data. Aggregate data are included for each department, and summary data are included for each of the colleges and for the entire university. Ten simulation and forecasting models were developed to estimate the future student body and faculty characteristics, facility utilization, and revenues and expenditures. The management reporting system translates the 5-year planning budget into annual operating plans. A literature review and bibliography are included. (SW)

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DEVELOPMENT OF A PLANNING AND INSTITUTIONAL RESEARCH SUBSYSTEM AT GRAMBLING STATE UNIVERSITY

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THE ASSOCIATION FOR INSTITUTIONAL RESEARCH

This paper was presented at the Twenty-Third Annual Forum of the Association for Institutional Research held at the Sheraton Centre in Toronto, Ontario, May 23-26, 1983. This paper was reviewed by the AIR Forum Publications Committee and was judged to be of high quality and of interest to others concerned with the research of higher education. It has therefore been selected to be included in the ERIC Collection of Forum papers.

D. R. Coleman, Chairman
Forum Publication
Advisory Committee

DEVELOPMENT OF A PLANNING AND INSTITUTIONAL RESEARCH SUBSYSTEM AT GRAMBLING STATE UNIVERSITY

ABSTRACT

This paper discusses why and how Grambling State University, a national and internationally known institution with a current enrollment of 3970 students, proceeded to develop and implement a Planning and Institutional Research Subsystem. The paper uses a case study approach in explaining the three primary aspects of the subsystem: (1) Grambling Institutional Data System (GRIDS); (2) Simulation and Forecasting Models; and (3) Management Reporting System.

The paper suggests that an institution can assure its success in developing a Planning and Institutional Research Subsystem by commencing the project with a carefully prepared design document and by implementing a simple version of the system at the outset. Lastly, the paper discusses how GSU has improved the allocation of the institution's available resources.

INTRODUCTION AND PERSPECTIVES

Grambling State University is a national and internationally known institution located in the rural North Central region of Louisiana. The university is a public institution which has traditionally served a predominant population of black students who are economically, educationally and socially disadvantaged. The institution has a current enrollment of 3970 students, of which seventy-four percent are housed in campus dormitories. Approximately ninety-five percent of GSU's students receive financial aid. GSU has 208 full-time faculty members.

Managing GSU has become increasingly complex in recent years. This complexity has been exacerbated by uncertain support, the steady rise in the cost of facilities, energy and instructional services, the greater demands for accountability by external publics, the decline in financial aid, the increased pressures created by the settlement of the Higher Education Desegregation Litigation in the State of Louisiana, the increasing number of high-risk students, and the ever-increasing demands for new and improved course offerings and expanded student services.

Most of the aforementioned problems are common to many institutions of higher education. However, these problems assume greater significance at GSU because they represent basic threats to the survival and self-sufficiency of the institution. GSU has no endowment fund or other assets that have revenue-generating potential. Additionally, extramural support from foundations and corporations has been minimal. Increased state appropriations are primarily contingent upon a funding formula that is enrollment driven. Therefore, GSU has limited power to control the flow of resources to its "coffers". Since the direction of resource flow at GSU is highly unstable and uncertain, top level management officials were compelled to devise a better way of managing and controlling those resources

which the institution received via state appropriations. GSU's executive management had to make decisions - often crucial decisions - based on incomplete, inaccurate, untimely and inadequate information. Data and information which were necessary for optimal decision making and strategic planning were not readily available.

Consequently, the allocation of available institutional resources was made primarily on the basis of "seat of the pants judgments" and "relative urgencies". There was an obvious need to develop a mechanism for the systematic and rational allocation of available resources.

COMPUTING ENVIRONMENT

The university is currently engaged in a program to strengthen its management capabilities. This program is funded primarily by a Title III grant from the U.S. Department of Education. The State of Louisiana has supplemented the Title III funds by providing funding for some specific items, e.g., computer hardware.

The program included an effort to formulate and develop a management development and training program for professional and non-professional staff members to upgrade the managerial skills of those with administrative responsibilities. Another part of the program, the subject of this paper, was aimed at providing better information on a timely basis to all levels of GSU's management. GSU's managers had to rely on limited staff efforts to satisfy only a portion of their information needs. For the most part, reports were generated manually, rather limited in scope, and frequently completed long after they were really needed. There was an apparent need for most of this information to be generated by the GSU computer center so that managers could have accurate, comprehensive and timely data on the university's operations and programs.

The capabilities of the GSU computer center to support administrative functions have been enhanced in recent years by upgrading and adding computer hardware and

software. This evolutionary process has led to the current PDP 11/70 computer configuration with 608K words of core memory and 176M bytes of disk storage space. It currently supports 37 remote terminals for instructional and administrative users. In the near future, an additional, medium-sized mainframe computer (VAX 11/780) will be installed to establish a dual hardware configuration. Current plans call for the VAX to be dedicated to instructional and research use, making the entire PDP 11/70 system available for administrative use. This will result in a dramatic increase in the potential for providing administrative support. Additional terminals will be installed to facilitate computer access by all administrative users.

The collection of software available at the GSU computer center has been expanded to include the major general purpose computer languages and standard statistical packages, i.e., COBOL, FORTRAN, BASIC-PLUS, PL/1, RPG, SPSS and MINITAB. The POISE Data Management System has been installed along with most of the available POISE modules. These include: (1) Data Management System, (2) Financial Accounting System, (3) Registration and Student Records, (4) Payroll System, (5) Student Billing/Receivables, (6) Financial Aid System, (7) National Defense Student Loan, (8) Personnel System, (9) Fixed Assets, (10) Alumni/Development, (11) Inventory System, (12) Admissions System, (13) Position Control System, (14) Student Affairs - Housing, (15) Student Affairs - Student Life, and (16) Library System. All of these systems are either fully operational now, or will be within a few months. Other POISE modules for financial management and accounting will become operational in the near future. These POISE modules are the major transactional information systems (TIS) in use at GSU.

Other, more specialized, software include: (1) Enrollment/Recruiting (2) Long-Range Planning/Budgeting, (3) Instructional Cost Index, (4) Resource Allocation, (5) Tenure, (6) Resource Requirement, (7) Unduplicated Head Count Enroll-

ment, (8) Salary Planning, (9) Student Information, and (10) Productivity Indices. These have been developed by the Office of Planning and Institutional Research to support some of the planning, management and evaluation (PME) functions. In the past, PME analyses were conducted on an ad hoc basis, largely without adequate computer support. This deficiency has been overcome by the development of additional software, specifically designed to support the PME function.

GSU plans to improve the computer support for administrative operations by expanding its on-line, interactive capabilities, and by developing a hierarchy of information systems (HIS/MIS) over the next five years. The impending installation of the VAX 11/780 for instructional and research use will contribute significantly by increasing the practical limitations on the number of simultaneous, on-line administrative users which can be accommodated. The HIS/MIS will enhance and strengthen GSU's management capabilities by providing the information necessary to support administrative activities at all levels. The HIS/MIS include (1) Transactional Information Systems (TIS) for the routine daily operations of the university, (2) the Management Information System (MIS) which produces analytical reports from the TIS data base for institutional managers, and (3) the Planning and Management System (PME) which further integrates transactional data and external information to support planning and management decisions.

PURPOSE

The purpose of this paper is to describe how GSU developed and implemented a Planning and Institutional Research Subsystem to improve the effectiveness and quality of decision-making at the institution. Moreover, the paper discusses how the system provides timely, accurate, and comprehensive information about the efficiency of GSU's operations and program offerings to effectuate a more productive utilization of the university's limited resources.

Having as its primary emphasis the providing of decision support to GSU's

executive management, the computer-based planning information system has three primary components: (1) Grambling Institutional Data System (GRIDS), (2) Simulation and Forecasting Models, and (3) Management Reporting System. These three components will be discussed later in the paper.

WORKING DEFINITIONS

For purposes of this paper, "planning" and "institutional research" will be used interchangeably. Likewise, "subsystem" and "system" will be used in the same manner.

The Planning and Research Subsystem is called a "subsystem" because it is a functional subsystem of the HIS/MIS. More specifically, for this paper we will use the following definition of a subsystem:

> A functional subsystem of an MIS is a defined set of internal, official, and formal management procedures and processes by which data and information, including reports, on which management decisions and information releases on a selected area of organizational functional activities can be based, are furnished to executives and administrators of an organization. (McManis, 1978, p. 6)

LITERATURE REVIEW

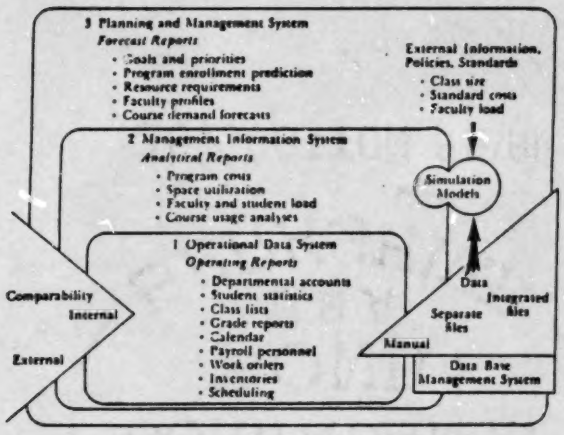
A crucial step in the design and development of GSU's Planning and Research Subsystem was the identification and selection of an appropriate conceptual framework. In reviewing the relevant literature, it was discovered that Comstock (1970), Sheehan and others (1972), Haight and Romney (1975), Lawrence and Service (1977), Lasher (1978), McManis and Parker (1978), Sheehan (1980), and Doty and Krumrey (1982) conceptualized some fundamental ideas about the development of a hierarchy of information systems.

After careful study, the Office of Planning and Institutional Research (OPIR) decided that the paradigms suggested by Sheehan (1980), McManis and Parker (1978), and Doty and Krumrey (1982) provided the necessary conceptual framework for the design and development of the Planning and Research Subsystem.

Sheehan's paradigm (1980), as evidenced in Figure 1, presents a hierarchy of information and categorizes them into three levels: (1) Transactional Information Systems (TIS), (2) Management Information Systems (MIS) and (3) Planning and Management Systems (PME). The essential foundation of the hierarchy at the first level (TIS) of operation is data collected in the regular and routine activities of the institution. The second level in the hierarchy (MIS) will produce analytical reports from the TIS data base for institutional managers. At the highest level (PME) is the further integration of transactional data and external information to support planning and management decisions. (p. 512)

FIGURE 1

Hierarchy Of Information Systems

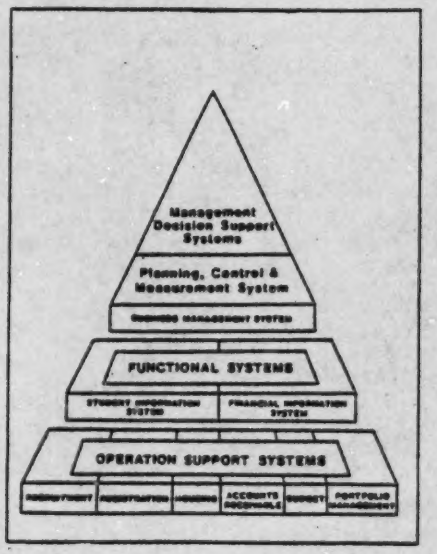


Doty and Krumrey (1982) in their paradigm stress the fundamental difference between the operation support system and the decision support system (See Figure 2). In their framework the objective of an MIS is to convert voluminous raw data into useful information for management decision making. Integration of the operation support and functional systems into one consolidated business management system provides the mechanism by which a manager receives information to conduct analysis and to solve problems (p. 21). Notice that the paradigm includes a planning, control and measurement system as an essential part of the

decision support system.

FIGURE 2

The Management Information System



In the paradigm formulated by McManis and Parker (1978), the institutional research and planning support module is a subsystem of the MIS (See Figure 3). The paradigm shows how the report production of other MIS subsystems will provide improved decision support to the continuous planning and institutional research needs of the university. Additionally, the model suggests that the planning and institutional research activities can be significantly enhanced by a subsystem which is capable of generating special (one-time) reports as required. The existing computerized data banks or a central MIS data base provides the essential data for these reports. A general purpose report generator capability can be created to support the institution's executive and administrative management by linking all of the existing data banks to the planning and research subsystem (p. 50).

FIGURE 3

A Typical College or University MIS

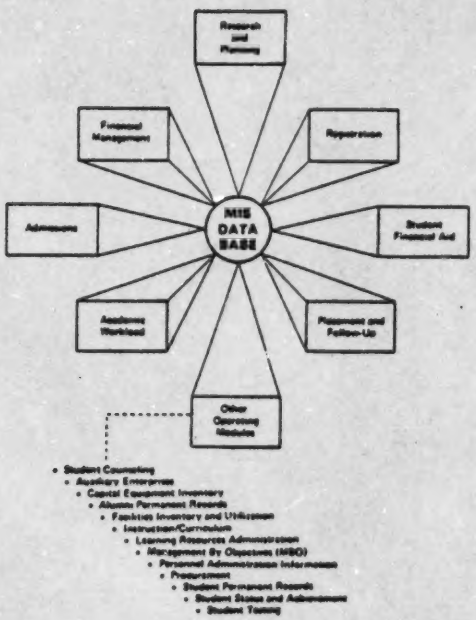


FIGURE 4

Summary of Subsystem Design Requirements

McManis and Parker (1978) formulated the specific design requirements of planning and research subsystems (See below). These requirements are the operational functions and the report production capabilities of the system.

THE INSTITUTIONAL RESEARCH AND PLANNING SUPPORT MODULE

Desired Subsystem Capabilities:

Operational Functions:

- *Provide for interaction with all existing computerized data banks (or the data base) so the subsystem can generate a wide variety of special reports to assist management in conducting institutional research and planning.*
- *Provide for a computer (simulation) program to be developed (or purchased) by the institution which would permit futuristic analyses of academic offerings, instructional/instruction workload, faculty requirements, changes in the enrollment mix, and financial stability, etc.*

Report Productions:

- *A variety of special (one-time) reports to assist management in conducting institutional research and planning activities.*

The conceptualization of McManis and Parker (1978) was employed in justifying a request for Title III funding and in the ultimate development of GSU's Planning and Research Subsystem.

METHODOLOGY/APPROACH

The case study method was selected in order to provide sufficient detail and analysis to illuminate the process by which GSU developed its Planning and Institutional Research subsystem. This approach was also used to indicate how the subsystem was employed in supporting and improving the process of decision making, especially the allocation of the institution's limited resources.

The case, as presented, is nothing more than a description of a real-life institutional problem. However, the authors believe that this case can serve as a useful teaching and learning device in that it evidences how theoretical and conceptual frameworks can be applied to an actual problem or situation.

DISCUSSION

When GSU implemented its planning process on September 1, 1980, the process was not supported by a reliable and comprehensive data base. GSU's executives and administrators were convinced by the Executive Director of Planning and Institutional Research that current and reliable information was a basic ingredient for effective decision making in the implementation of a strategic plan and in the evolution of outcomes of the strategic planning and budgeting process. Moreover, the administration was made aware of the need to develop a system for collecting and assimilating data so that the university could make expeditious responses to requests of external agencies for information about its programs and operations.

Recognizing that the quality of planning could not consistently arise above the quality of information on which it was based, the university took some necessary steps to improve the planning technology at the institution. As used here,

"planning technology refers to the information systems (institutional and non-institutional data bases), the data processing systems (manual and semi-automated as well as computer hardware and software) and the analysis and research techniques that serve the planning function" (Peterson, 1980, p. 116).

An important step in improving GSU's planning technology was the development of a Planning and Institutional Research Subsystem. During the summer of 1982, the Executive Director of Planning and Institutional Research decided that the conceptual framework of McManis and Parker (1978) provided an excellent basis for the design of the subsystem. It was also decided that the subsystem would have three primary components: (1)GRIDS (Grambling Institutional Data System); (2) Simulation and Forecasting Models; and MRS (Management Reporting System). To assure success in developing the system, a design document was carefully prepared with the assistance of an external consultant. The design document was completed during the month of September, 1982, and it contained the desired system capabilities. The design document included detailed discussions of the data base structure, the extraction and report generation procedures and the necessary steps to implement the subsystem.

Five important principles were utilized to govern the implementation of the subsystem:

- User motivation - Every employee involved with the system must be motivated to use it properly; conversely, the system must be designed to aid in the motivation.

- Early results - The system development should be organized in such a way that tangible system outputs are produced early, preferably within the first year.

- The simple approach - As the system is being developed, managers should favor consistently the simple approach. To the extent that simplicity can be achieved, the chances of realizing a successful system increase.

- Maximum system flexibility - An organization should not expect to achieve the optimum system on the first go-round. The system design should be an iterative process, in which the results of experiences are built upon to improve the capabilities and responsiveness of the system.

- Data purification - It is necessary to develop standard-data definitions and promulgate them to all potential sources of data for the information system. Also vital, is the review of historical-data to determine how it can be incorporated into the information system data base without distortion. (Comstock, 1970, p. 194)

GRIDS

The Grambling Institutional Data System (GRIDS) was developed for the Office of Planning and Institutional Research. It is designed to run on the PDP 11/70 at the GSU Computer Center. It consists of a historical data base and a collection of extraction and reporting routines to produce formatted tables using the contents of the data base. The historical data base contains two types of information -- academic and financial. The academic information has to do with students, faculty, courses, credit hours, etc. Aggregate data are included for each of the academic departments. In addition, summary data are included for each of the several colleges and for the entire university. The data base also contains financial and/or budgetary information. Data are included for the GSU planning and budgetary units, such as the President's Office, Registrar's Office, Admission's Office, and each of the several colleges. The system uses the POISE Data Management System to extract data from the data base and to produce desired reports.

To facilitate the evaluation of trends, data are included for each of five academic years wherever possible. The fact that data are included at an aggregate level rather than at the individual student and faculty member level imposes some restrictions on the types of reports which can be generated. Basically, this means that when breakdowns below the department level are needed, they must be included as such in the data base. Thus, for example, if the number of Black faculty members is required by department, this must be included as a separate data element.

The scope of the data included initially was restricted to selected data

elements for the five academic years 1976-77 through 1980-81. This allowed the system to be implemented without delay, since the OPIR could provide the data to the computer center in that form with a minimum of effort. Other data elements for these years and complete data for 1981-82 were added later, after GRIDS was operational and the OPIR had gained some experience with its use.

GRIDS has been used to produce a variety of reports which display either 5-year trends in selected data elements or a collection of data elements for a single academic year. These reports provide breakdowns by individual academic department or planning unit. The system provides for three basic report formats (Copies of the three GRIDS report formats are available upon request from the authors).

The first standard format is designed to show the five-year trends in a chosen data element, for example, full-time enrollment, for each Grambling academic unit. Thus, each row corresponds to a department or college and each column corresponds to an academic year.

The second standard format is designed to show the five-year trends of selected data elements for Grambling as a whole. Thus, the X_1,X_2, etc., in the rows correspond to different data elements. For example, these could be full-time enrollment, etc., as required for an enrollment report.

The third report format is cross-sectional in nature, that is, all data pertain to a specific academic year. The rows correspond to individual academic units, and the columns now correspond to different data elements. Thus, one can compare a collection of data elements at the department level.

The layouts presented above correspond to reports to be generated from the academic data files. Reports from the financial data files are similar, except

that the breakdowns are given in terms of planning rather than academic units, i.e., the President's Office, Registrar's Office, Admission's Office, individual department level.

Other reports were constructed using the POISE Data Management System on an ad hoc basis.

After the initial implementation, the GRIDS data base was expanded to include all of the data elements which the OPIR required. Additional POISE procedures were written to provide percentage distributions, year-to-year changes, and trend projections directly in various reports. It is important to point out that the OPIR implemented the simple version of GRIDS described in the design document. The aforementioned additional capabilities were only added after the simpler version was operational.

SIMULATION AND FORECASTING MODELS

Simulation and forecasting models are an integral part of Grambling State University's computer-based planning information system. The development of the following simulation and forecasting models has provided the management team at Grambling State University with a systematic and orderly method of analyzing policy:

(1) Enrollment/Recruiting
(2) Long-Range Planning/Budgeting
(3) Instructional Cost Index
(4) Resource Allocation
(5) Tenure
(6) Resource Requirement
(7) Unduplicated Head Count Enrollment
(8) Salary Planning
(9) Student Information
(10) Productivity Indices

It is important to point out that these models were initially developed on a TRS-80 microprocessor and later refined and stored in the memory of the PDP 11/70.

The simulation and forecasting models were employed at Grambling State University to provide estimates of future student body and faculty characteristics, facility utilization and revenues and expenditures. The forecasting models ranged from simple, linear trend projections to more sophisticated multivariate analyses. The simulation models provided the additional capability to measure the sensitivity and/or stability of results to changes in hypothesized inputs.

These models were varied in scope and technique. Therefore, it was not feasible to provide software, which was sufficiently general, to encompass them all. A certain amount of capability to project trends in key data items was afforded by GRIDS.

Simulation and forecasting models were central to the planning function at Grambling State University. These models provided rational criteria for weighing the range of available alternatives and the resources required for implementation.

MANAGEMENT REPORTING SYSTEM

GSU's Management Reporting System was developed so that evaluation of the outcomes of the university's strategic planning and budgeting processes could take place. After unit plans had been approved for implementation, the OPIR had to determine a suitable approach to integrating these plans with MBO in order to systematically monitor and evaluate progress in achieving objectives.

GSU's unit plans were designed to delineate clearly annual objectives. The plans, therefore, were easily translated into an MBO system which was computerized so that regular reports were produced to give managers a constant flow of information on the status of their operations.

A prerequisite for automation of the Management Reporting System (MRS) was the training of directors and supervisors in the use of the MBO process. Training materials were designed and training sessions were given. The sessions focused on three topics: (1) "The Contemporary Role of the Unit Manager"; (2) "MBO - A Tool for Monitoring and Evaluating Progress", and (3) "The Use of the MRS in the MBO Process".

The development of the Management Reporting System has given the university the ability to translate its Five Year Planning Budget into annual operating plans.

For every major planning/budgeting unit at the university, the MRS will generate an Annual Operational Plan containing the following elements:

(1) Identity of reporting unit

(2) Name of responsible manager

(3) Names of individuals responsible for specific milestones (tasks)

(4) Statement of Purpose and Statement on Proposed Propitious Niche

(5) Objectives

(6) Performance Evaluation Measures

(7) Implementation Strategies

(8) Milestones

(9) Time Frames

(10) Budget

(11) Budget Notes

Elements 5, 6, 8, and 9 provided the fundamental basis of GSU's evaluation strategy. The evaluation of operational plans was an important phase of the university's planning and management system. Approved objectives became the agenda for a series of quarterly reviews. Each manager could chart his progress in attaining approved objectives through the utilization of a milestone reporting technique.

RESULTS

The development and implementation of GSU's Planning and Institutional Research Subsystem have greatly improved the institution's ability to carry out the three primary and ongoing functions of planning, managing and evaluating. It is our opinion that the system has brought about a more productive utilization of GSU's limited resources. Moreover, the system has been able to generate timely, accurate, and comprehensive information about the efficiency of the institution's operations and program offerings. As an example, last year the university was able to reallocate $300,000 from non-productive programs to productive and high-growth programs.

IMPLICATIONS FOR PRACTITIONERS

All institutions regardless of size, during this era of dwindling resources and increasing accountability, will ultimately find a need to develop a capacity for the integration of transactional data in support of planning and management decisions. Institutions will also find a need to develop the capacity to evaluate the consequences of decisions as well as the alternative strategies available to decision-makers. The development of these capacities will enable the institution to improve on its method of allocating scarce resources during this period of economic uncertainty.

An institution can assure its success in developing a Planning and Institutional Research Subsystem by commencing the project with a carefully prepared design document and by implementing a simple version of the system at the outset. The design document should contain detailed discussions of the data base structure, the extraction-and-report-generation procedures, and the steps necessary to implement the system. In implementing a simple version of the system, the scope of the data included initially could be restricted to selected data elements for five academic years. Other data elements and other years could be added

later, after the system is operational and the Planning and Institutional Research Office has gained some experience with its use.

After the initial implementation, the system's data base can be expanded to include all the data elements which are required.

Additonal software procedures could be written to provide percentage distributions, year-to-year changes, trend projections directly in reports, etc. However, the simple version of the system should be implemented first. These additional capabilities should be added later after the simpler version is operational.

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